Scientia Canadensis
Canadian Journal of the History of Science, Technology and Medicine
Revue canadienne d'histoire des sciences, des techniques et de la médecine

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Volume 20, numéro 49, 1996

URI : https://id.erudit.org/iderudit/800398ar
DOI : https://doi.org/10.7202/800398ar

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Éditeur(s)

CSTHA/AHSTC

ISSN

0829-2507 (imprimé)
1918-7750 (numérique)

Découvrir la revue

Citer cet article

Bowley, P. (1996). Ontario Agriculture in the 1910s: The Move Toward Regional Specialization in Crop Production. *Scientia Canadensis*, *20*, 100–121. https://doi.org/10.7202/800398ar

Résumé de l'article

Jusqu'au début des années 1910, la plupart des fermiers ontariens pratiquaient une agriculture mixte et visaient d'abord l'auto-suffisance, les surplus étant vendus pour se procurer les autres biens nécessaires à la vie rurale. Au cours de la décennie 1910-1920, la spécialisation commence à être perçue comme un moyen pratique d'améliorer les revenus de la ferme et le niveau de vie de la famille. La prise de conscience que les conditions climatiques et géographiques ne sont pas également favorables à toutes les récoltes et le désir de conserver la qualité du sol tout en maximisant les profits, sont deux facteurs importants qui expliquent ce mouvement de spécialisation agricole. Le Ministère ontarien de l'agriculture et le Collège ontarien d'agriculture de Guelph ont joué un rôle actif dans la recherche et la diffusion des connaissances en agriculture. Leurs programmes ont ainsi permis aux fermiers de choisir les plantations et les méthodes de gestion des sols les mieux adaptées à leur situation géographique et climatique.

Ontario Agriculture in the 1910s: The Move Toward Regional Specialization in Crop Production

PATRICIA BOWLEY

ABSTRACT:

Until the beginning of the 1910s, mixed farming was the most common type of agriculture in Ontario and was based on "self-subsistence": the farm family produced as many of the essentials of life as possible and traded for the other things they needed. During the decade 1910–1920, specialization was recognized as the most practical way to earn a comfortable living at farming. There were two important reasons for this move: the recognition that all crops were not adapted to each climatic and geographic region of Ontario; and the desire to farm according to the principles of soil conservation or "good farming" while still maximizing profits. The Ontario Department of Agriculture in conjunction with the Ontario Agricultural College at Guelph was very active in conducting research and extension work. Through these programs, farmers were able to choose the particular crops and soil management systems which were the best for them.

RÉSUMÉ

Jusqu'au début des années 1910, la plupart des fermiers ontariens pratiquaient une agriculture mixte et visaient d'abord l'auto-suffisance, les surplus étant vendus pour se procurer les autres biens nécessaires à la vie rurale. Au cours de la décennie 1910–1920, la spécialisation commence à être perçue comme un moyen pratique d'améliorer les revenus de la ferme et le niveau de vie de la famille. La prise de conscience que les conditions climatiques et géographiques ne sont pas également favorables à toutes les récoltes et le désir de conserver la qualité du sol tout en maximisant les profits, sont deux facteurs importants qui expliquent ce mouvement de spécialisation agricole. Le Ministère ontarien de l'agriculture et le Collège ontarien d'agriculture de Guelph ont joué un rôle actif dans la recherche et la diffusion des connaissances en agriculture. Leurs programmes ont ainsi permis aux fermiers de choisir les plantations et les méthodes de gestion des sols les mieux adaptées à leur situation géographique et climatique.

In 1910, one of the most striking aspects of Ontario agriculture was its regional nature, and by 1920, Ontario agriculture had become almost entirely specialized according to climatic and geographical regions of the province. Data collected in 1923 by the Statistics

Branch of the Ontario Department of Agriculture reveal that all major field crops were grown in almost every Ontario county in some small, or trace, amount. Pasture and orchard and small fruits were likewise ubiquitous.[1] Regional specialities developed, however, due to the extreme variability of conditions for cropping throughout the province. Important climatic parameters such as absolute seasonal temperatures, temperature extremes, and annual precipitation determined the potential for success of any crop species. Soil type varied from north to south, from east to west, and sometimes even within the boundaries of an individual farm. Social factors also impacted on Ontario agriculture to push it towards specialization; for example, while modern machinery displaced the horse, modern transportation and storage technology increased the demand for animal products like meat, milk and cheese in markets which were distant from the farm. Finally, the availability of expert advice allowed a farmer to concentrate on a specialty for which he and his farm were ideally suited.

Clearly the value of improved farming, or mixed farming, was widely acknowledged by the early 1870s.[2] A most important component of this new system of farming was manure to improve the soil. The introduction of more and different species of animals onto farms was the key to diversified and improved agriculture between 1870 and the early 1900s. The increase in the number of farm animals was driven from both sides of the farm gate. Inside the gate, manure, long shunned by Ontario farmers who believed it spread rust and fungi, was finally accepted for its potential to improve soil structure and therefore productivity.[3] At the same time, beyond the gate, new technologies in cold storage, and in butter- and cheese-making, increased the demand for Ontario animal products. Between 1882 and 1910, the numbers of poultry, swine, dairy and beef cattle, and horses, all increased in the province as a whole.[4] Thus mixed farming, definitely a *fait accompli* by 1870, resulted from a combination of very complicated factors, including the need to restore the productive capacity of the soil, and to take advantage of growing market opportunities.[5]

During the years that mixed farming was widely practised in Ontario, scientific agriculture gained importance. Scientific agriculture is a difficult term to define; it relied on the practice of problem-solving by applying principles learned through observation and extrapolation from one set of circumstances to another set elsewhere. Specialists were often employed by governments to conduct experiments and prepare conclusions. In 1877, a Dominion

Council of Agriculture was established, with 12 committees, including one which dealt with scientific agriculture. During the next few years, the Central Experimental Farm, and several sub-stations across Canada, were established. The Canadian government employed scientists, mostly specialists, at these centres, where controlled experiments could be conducted and results compiled. This collection of quantified information by governments was understood as an aspect of modernisation. As a consequence of the amounts of information collected, scientists became more and more specialized within a particular discipline.[6]

Unfortunately, the term "scientific" agriculture might imply that only specialists, or scientists, recognized the need for a new approach to farming. Scientific agriculture, however, had a very specific and very practical aim. William Brown, Professor of Agriculture and Farm Superintendent at the Ontario Agricultural College (OAC), Guelph, from 1876 to 1887, stated that "the scientist could only assist the farmer once the latter had isolated the practical problems he needed to solve and found that he alone could not solve them through long experience or experiments he could design to improve his understanding."[7] For his part, the farmer had to accept this expert advice, and integrate it into his own farming operation. Intellectual agriculture is actually a much more appropriate term than scientific agriculture, because it suggests the thoughtful implementation of information gained, through scientific research, by the practitioner of agriculture himself. Many farmers did take note of scientific advice offered to them to improve both present and future productivity. Enrolment at OAC increased annually, as farmers sent their sons to be educated. In addition to accepting information, farmers needed economic stability, which provided flexibility enough to try out new methods and crops.

In 1909, the *Farmer's Advocate* published an editorial entitled "Mixed Farming Specialized"; this was a commentary on an ongoing debate by the Brant Township Farmers' Club in Bruce County. The teams evaluated both specialty and mixed farming, and the debate ended in a tie. The main points were reproduced in the newspaper for interested farmers to read.[8] The editors, however, advocated a blend of the two methods, "a well-ordered system of specialized mixed farming".[9] This was an informed conclusion that straightforward mixed farming was no longer feasible in rural Ontario. A call for specialization in farming, and its adaptation to modern business methods, came from John Macdougall, cler-

gyman and commentator on farming and rural life. He wrote, in 1913, that the "efficiency of agriculture calls for organization and specialization corresponding to those which have made modern industry productive."[10] Specialized farming, or the agriculture of the twentieth century, was in keeping with intellectual agriculture; the modern farmer obtained expert information from many diverse sources. He was encouraged to focus on a specific problem until it was solved. In this way, many farmers eventually became experts and specialists themselves in one particular aspect of agriculture, and produced those commodities almost exclusively. Given the infinite number of geographic and climatic combinations in the province, a typical farmer did not exist, and specialization, usually within the framework of a mixed farm, was the norm. Within the business of agriculture, each farmer had carved out a particular niche in the marketplace.

AGROMETEOROLOGICAL CONCEPTS

To state that Ontario agriculture developed along regional geographic and climatic boundaries, without providing some explanations of terms and concepts of agrometeorology, would be negligent. In the 1910s, the physical basis of agriculture included the physiography, or surface character, of the province, the climate, and the soil. Each of these three factors depended on the other two in a complex and variable relationship. In 1914, a Preliminary Survey of the soils and related features of southern Ontario was begun at OAC, in the Department of Chemistry. This survey was intended to obtain a broad and general idea of the larger and more important soil areas of the province and how they interacted with climate. The following is a short synopsis of the ways in which climate and soils influenced the choice of crops and the subsequent move to specialized agriculture.

The climatic factors which influence the growth of plants are the length of the growing season, temperature, rainfall, humidity, amount of sunshine and intensity of light. The length of the growing season, from the last killing frost in spring to the first killing frost in fall, is arguably the most important climatic factor affecting crop distribution in Ontario. Large bodies of water, such as the Great Lakes and Lake Simcoe, have an effect on both summer and winter temperatures. Near these lakes, temperature extremes are rare, and mean annual and seasonal temperatures are lower in summer and higher in winter than further inland. The lakes also

extend the frost-free period in spring and fall by virtue of their moderating influence. For example, Renfrew county, in land-locked central Ontario, had recorded frost in every month except July during the early years of the twentieth century. Latitude and elevation also influence the length of the growing season; farms which are further north and at higher elevations generally have shorter growing seasons and lower annual temperatures. Average monthly and annual temperatures, and daily and seasonal maximum and minimum temperatures, are important in crop selection. In Ontario, these vary considerably with the movements of polar and tropical air masses and storms across the North American continent.

On average, annual precipitation in all parts of Ontario is sufficient to support plant growth, and it is evenly distributed over the twelve months. Precipitation is also influenced by topography. The driest sections of the province are northern and western lakeshores, especially the shores of Lakes Erie and Ontario, and the rainshadow or eastern edges of the Niagara Escarpment. Marked regional variability occurs even a few miles apart, and from month to month. Precipitation as snow is of vital importance for the survival of winter crops and perennials. Snow cover insulates the top soil layers, where dormant plant parts overwinter, from extreme temperature fluctuations, and prevents frost heaving of the plant out of the ground. Dry areas also receive less winter snow, and overwintering plants are more susceptible to low temperature damage. Bright sunshine is as important as precipitation for crop production; in Ontario, the percentage of sunshine generally decreases from south to north, although well-marked belts receiving the same percentage of sunshine extend across the province in a southwesterly direction. The extra amounts of bright sunshine received in the lakeshore areas of Lakes Erie and Ontario mean greater drought frequency in those areas, since these are also the areas of least annual precipitation.

The diversity of soil types in Ontario is related to prehistoric glaciation, the retreat of glaciers and the deposition of parent material for soil formation. There are several characteristics of soils which contribute to their ability to support crop growth. Texture refers to the particles which were derived directly from parent material: clay (smallest or heaviest), sand (largest or lightest) and loam (intermediate). Most soils are mixtures of these; aggregation of particles gives the soil its structure, another identifying characteristic. The capacity of a soil to provide nutrients for crop growth

is closely related to soil texture. Sandy soils are low in organic matter and clay particles. These are necessary for water storage and available nutrients. Water moves freely through the light-textured sandy soils and depletes them of nutrients; these soils are prone to drought. Heavier-textured clay soils retain more plant nutrients, but they can be poorly drained, and suffer from water-logging. The lighter-textured soils generally warm up earlier in the spring, because of their lower moisture content.

Other soil characteristics are important to cropping. Organic matter in the soil improves the structure by stabilizing aggregates, holding water and nutrients, encouraging deeper rooting, and improving soil aeration. Because organic matter is dark in colour, it increases the heat-absorbing capacity of a soil, and helps it become warm and dry earlier in the spring. The chemical composition of the soil determines crop distribution and yield. Most crops have a definite narrow optimum range of chemical reaction conditions. Furthermore, soil chemistry affects the availability of certain nutrients to plant roots. Soil pH – acidity or alkalinity – is a function of texture and organic matter content, with clay soils being the most acid. Soils which are extremely acid (such as in eastern Ontario) have a limited range of crop capabilities. Most crops have a pH optimum near neutral pH (pH 7).

A final important soil characteristic is drainage. Sandy soils drain readily, although erosion by wind and water can be problematical. Clay soils may suffer from impeded drainage. Spring planting is delayed on poorly-drained lands, and crop yields and the range of crops which may be grown are reduced. Drainage, however, is one of the characteristics of soil which can be altered, through the installation of subterranean tiles and ditches at the margins of tiled fields. The Ontario legislature recognized this in 1878. Through the Ontario Tile Drainage Act, townships were able to procure funds from the provincial treasury. This money was loaned to any farmer who wished to install tile drains on his land, with repayment on easy and flexible terms.[11]

Harcourt, Iveson and Cline completed only a Preliminary Soil Survey for Southwestern Ontario in Bulletin 298, although they started a Detail Survey for Kent county in 1922. Since then, further work has resulted in a system of agricultural land classification for the entire province. It consists of two main parts: the capability class, based on the potential productivity of the soil, and the severity of any limitations or hazards for agricultural productivity; and the subcapability class, based on the hazard itself. Soils are

assessed only for their potential productivity of common field crops; special crops such as fruits, vegetables and tobacco are excluded. Even so, this classification system and the Canada Land Inventory (CLI) maps are most useful in achieving an even more complete understanding of how regional specialization proceeded in the 1910s.[12]

CROPPING IN ONTARIO IN THE 1910s

One of the most important crops in Ontario was feed corn, primarily for production in the southwestern part of the province. The *Farmer's Advocate* published many letters from farmers about their experiences with corn. Those who were successful came from southern counties, such as Oxford, Peel, Dundas and Middlesex, as well as Essex, but some corn was also grown further north. The Brant Township Farmers' Club (Bruce county) debated "Corn versus Roots", and concluded that roots, including turnips and mangels, were a better feed crop for their area.[13] The Ontario Corn Growers' Association was organized in Essex county in 1909, largely through the work of the District Reps. Feed corn was shown to be profitable, and most farmers in southern Ontario acknowledged that corn silage was superior in every way to dried cobs stored in a crib. The Ontario Department of Agriculture conducted a three-year experiment, in conjunction with the farmer members of the Ontario Agricultural and Experimental Union, an extension program run by the OAC. They tested varieties of corn for silage. This experiment took specialization a step further; in addition to choosing the most suitable crop for their farm, farmers would be able to choose the best variety of that crop. The experiment included observation and analysis of growth of the corn stock, size of the leaf, number and size of ears, freedom from disease, date of maturity, and yield data.[14] By 1915, there were 804 silos in Waterloo county alone, as new varieties were developed which were suitable for planting in central Ontario.[15] This area had a shorter growing season (fewer frost-free days), and also lower daytime temperatures over the course of the summer. In such a climatic zone, vigourous vegetative growth for silage compensated for the inability of the plants to produce a mature cob.

Whatever specialty crop was chosen had implications for the conservation of the soil. The results of choosing corn as a stored feed in Ontario were far-reaching. Gradually, corn replaced other crops which had been grown as winter feed: roots, like turnips and

mangels and even some carrots, and peas. But corn called for some new procedures. Corn did not fix nitrogen, like peas, because it was not a legume; therefore nitrogen fertilizer had to be heavily applied to the soil. Alternatively, corn could be seeded into a young clover sod (clover was another nitrogen-fixing legume). The entire corn plant was harvested, so there was no green leafy material to plough back under, as the "soiling" root crops provided. Furthermore, the remaining woody corn stubble made cultivation difficult. Weed control was less efficient in a corn field than in a field of roots. Corn did have advantages, however, which were not necessarily associated with soil conservation. Because of its concentrated nutrient value (lower water content), both silage and dried cobs kept with less spoilage. A farmer could save seed from a good corn crop for planting the following year, whereas the biennial root crops never set seed.[16] Finally, corn was profitable. At the Macdonald College farm in Quebec, 30 acres of corn yielded 16 tons of ensiled plant material, for a saving of over $430 to the farm.[17] Some farmers who had grown corn for several years called it the "king of crops".

In contrast to corn, legume crops (including alfalfa, peas and clovers) had long been recognized for their ability to fix nitrogen, and make it available as fertilizer in the soil.[18] This characteristic of legumes made them invaluable in a crop rotation, especially immediately preceding a row crop. When they were ploughed under to prepare a seed bed for corn or roots, the leaves and roots decayed to add to soil structure and productivity, and nitrogen was made available to the new crop. Thus, legumes had both short-term (fertilizer) and long-term (soil improvement) benefits for soil conservation. By 1921, the provincial government was distributing nitrogen-fixing bacteria for inoculating the seed of sweet clover, alfalfa, red clover, peas, alsike clover, vetch, soybeans, sweet peas and beans.[19] These legume crops, except alfalfa and red clover, were most important when included in rotations as hay or pasture crops, often mixed with timothy. These were most successfully grown in the temperate counties of central and eastern Ontario, such as Bruce, Grey and Huron; Prince Edward, Peterborough and Simcoe; and Wellington. The soil in these counties was most suitable for legumes, which did poorly on acid soils. These soils also had sufficient calcium content, or lime, contributed by the parent material, to produce hay and pastures which were of high nutritional value to cattle.[20]

Whereas corn was known as the "king of crops", alfalfa was the "queen of forages". Alfalfa did double duty as a feed crop and a soil improver, and could be successfully grown further north than corn. Alfalfa had first been introduced from France into Canada, by way of Ontario in 1871. A single bag of seed was the source of Ontario Variegated alfalfa, which was the parent for early alfalfa breeding and improvement programs in Ontario and eastern Canada.[21] Some of the newer varieties were resistant to winter kill, a serious problem in Ontario. The Ontario Department of Agriculture and OAC tested these new types of alfalfa both for suitability for local conditions and freedom from weed seeds.[22]

Wheat, almost exclusively fall wheat, or winter wheat, remained part of crop rotations in Ontario. Fall wheat was an important crop everywhere except in the counties north of Sudbury, where the winters were extremely cold and long. In contrast, some spring wheat was grown everywhere, but mostly in the central Ontario counties of Renfrew and Carleton. In an editorial entitled "Wheat-growing in Ontario", the *Farmer's Advocate* highly recommended the inclusion of wheat in a cropping system. Wheat helped secure a good catch of clover when they were planted together. Wheat straw made good bedding material for animals; wheat provided good weed control, especially against wild mustard and wild oats; and the inclusion of fall wheat in a rotation spread the labour over the growing season.[23] In addition to these benefits, fall-planted wheat reduced soil erosion over the winter and into the spring. Ontario was once the most important wheat-growing region in Canada, and agricultural statistics show that wheat has never disappeared from Ontario agriculture.[24] Robert E. Ankli and Wendy Millar, D.A. Lawr, and William L. Marr each analysed the economics of wheat production, until the end of the first quarter of the twentieth century, without ever making reference to the priceless contributions to soil conservation and productivity which a wheat crop made.[25]

Other feed grain crops, including barley, oats, mixed grains (oats and barley planted together) and rye, were still relatively common in 1924, although as horses were slowly replaced by tractors and trucks, they became less important. Like wheat, they provided good weed control, although they were predominantly spring crops, and therefore much less competitive early in the season. All the small grain crops have extensive fibrous root systems which improve soil structure. Rye exhibited the greatest tolerance towards low winter temperatures and poor soil; it was most often grown on problem

soils, where its ability to overwinter successfully also reduced soil erosion. Its heavy vegetative growth and low cash value made it highly suitable as a green manure, or "soiling" crop. Selection and testing of introductions were carried on for each of the small grains at OAC in the early twentieth century, under the supervision of C.A. Zavitz. The results were distributed in 1915 in the form of "Farm Crops", OAC Bulletin 228.[26] By 1924, however, much of the small grain acreage had been given over to other crops, especially pasture, hay and feed corn, to supply the livestock, dairy cattle, swine and poultry which were very important to Ontario's agricultural economy.[27] Although pasture was arguably the most valuable crop in Ontario, it was difficult to estimate its cash value because it was consumed on the farm.

Specialty crops like flax, mustard and buckwheat filled particular niches in Ontario agriculture at the beginning of the twentieth century. Flax had been grown in Ontario since 1875 for fibre (linen) and linseed oil. It was especially important during World War I, but its extreme susceptibility to drought and wilt disease led to declines in acreage.[28] Mustard and buckwheat were highly effective weed control crops, through competition or "smothering" the weed plants and killing them.[29] Buckwheat was grown successfully in all except the northernmost and southernmost counties of the province. The contribution which specialty crops made to soil conservation is difficult to estimate. They satisfied a unique and often temporary demand, on very small acreages which did not form part of the systematic or long-term planned rotation.

Field crops were not the only ones to gain prominence in specialized farming. Fruit crops had been grown for many years on Ontario farms. In 1910, Ontario fruitgrowers produced apples, peaches, pears, plums, cherries, grapes, and small fruits (for example strawberries and raspberries).[30] They were well-suited to the moderate climate of the Niagara region, near Lake Ontario. Hardier apples and pears flourished further north, in Durham county, and also in the Grey/Bruce area, always most successfully next to a large moderating body of water. Certain varieties of apples, notably the MacIntosh Red, matured to a deeper red colour and firmer flesh in the cooler regions east of Toronto and along Georgian Bay.[31] District Representatives (Reps) and Farmers' Clubs in many parts of the province promoted small apple orchards for household use.[32] Fruit growing also became a specialty. Fruitgrowers and stockmen were both agriculturalists and businessmen, whose education, expertise, and capital for investment earned them prosperity and

prestige. In 1859, they had founded what became the Ontario Fruit Growers' Association. In 1894, the St. Catharines Cold Storage and Forwarding Company was chartered and controlled by affluent growers, many of whom devoted most of their time to farm business, and left the actual farm work to managers and hired help.[33]

Fruit farmers recognized the link between proper soil management in an orchard and a profitable crop.[34] The *Farmer's Advocate* recommended thorough cultivation, as opposed to leaving sod growing between the rows. As cultivation became more thorough and a long-term soil management program was established, fruit yield and quality increased, and farmers received more money per bushel.[35] The new provincial Experimental Fruit Farm, which was completed at Vineland in southern Ontario in about 1910, inaugurated experiments on many fruit crops. These included studies of tree fruits, soft fruits, and vegetables, irrigation, and soil management techniques such as cover crops and lime fertilizers. A perennial crop like fruit trees took some years to establish, however, and before any meaningful results could be gained from the demonstration orchards or the Vineland station, World War I broke out. Orcharding, particularly apples, suffered greatly from this event; continual shortages of labour and packaging materials, poor transportation and marketing facilities, combined with several years of cool, wet springs and summers, put a hold on most research. The focus shifted to plant breeding and canning and preserving studies, as the fruit produced in government programs was processed and sent to feed troops in Europe. Entomological work continued, including studies of specific insect pests, and tests comparing liquid spraying and dusting for pest control. During the war years, virtually no research on orchard soil cultivation took place, although the 1915 *Report of the Minister of Agriculture* contained a photograph of a well-cultivated cherry orchard. By 1914, the research program at Vineland was expanded to include vegetables. The focus of this new specialty was the production of seeds to replace European imports which had been stopped by the war.[36]

Apples, the hardiest of the orchard crops, received the most attention from agricultural experts. The *Farmer's Advocate* leased a three-acre apple orchard in Middlesex county for three years, beginning in 1909, and conducted a study of orchard management, including cultivation, cover crops, fertilizer, and accounts.[37] In the spring of each year, the *Farmer's Advocate* printed a "Calendar Guide to Spraying", compiled by a horticulturalist and an en-

tomologist at the Central Experimental Farm in Ottawa; this timely guide included formulae for insecticides and fungicides.[38] Particular attention was paid by the newspaper to the control of the apple codling moth.[39] The Ontario Department of Agriculture also leased and managed demonstration orchards, in six different counties.[40] After seven years, the orchards yielded heavy crops of prize-winning apples, even under poor conditions; the key to success was good spraying, manuring and tilling programs. In 1921, two new orchards were leased by the province, specifically for experiments on fertilizer application in orchards. Also in 1921, a demonstration storage station, or cold storage plant, was set up at Brighton. This innovative post-war program resulted from the new provincial government's emphasis on marketing of agricultural produce.[41]

SOIL MANAGEMENT IN ONTARIO IN THE 1910s

With the move to specialized farming, soil management techniques were also slowly changing. Crop rotation was important, because its benefits to the soil were widely recognized even though the variety of crops grown on a farm was becoming more limited.[42] In the best rotations, grain always followed sod (legumes and grasses) or a root or hoe crop (such as potatoes, turnips or corn).[43] Regular or systematic rotation, however, was still practised by too few farmers. In most cases their choice of fields for their crops was "haphazard". F.C. Hart was one of the first District Reps employed by the provincial Department of Agriculture. During extensive tours through Waterloo county over the course of the cropping season, he observed that the same crop was seldom grown on the same land two years in a row, although the farmer himself could not provide an explanation for his rotation. Nevertheless, a flexible rotation was practised, which may have depended on markets, weeds and other pests in a field, availability of seed, or many other complicated factors.[44]

Commentary and criticism of crop rotation has appeared in some of the agricultural history of Ontario. Robert Jones states that most farmers in early Ontario (1613–1880) had a relatively systematic plan in place, while others were adopting one unconsciously. The rotation, however, was apt to be disrupted depending on yield and marketability of a crop, and the need to clean up a weedy field.[45] Kenneth Kelly, a geographer, documents the "incidental" development of "scientific" rotations in Ontario, depending on markets and short-term profits.[46] Only Norman Ball defends

the random selection of certain fields for certain crops, as part of an adaptive transitional agriculture practised by innovative new farmers.[47] Dr. James Robertson, chair of the Committee on Lands of the Conservation Commission, Canada (CCC) was highly critical of Canadian farmers' systems of rotation. He asked, in his speech to the CCC in 1912:

> What is the difference [between some rotation, a rather irregular rotation, a definite rotation, and a systematic rotation]? The systematic rotation is the one that brings the crop in the right order of sequence. The systematic rotation always has the crops in right sequence for the locality, for fertility and for cleaning the land.[48]

The difficulty lay in defining "systematic" in a province as diverse as Ontario. The term systematic implied a rigid, long-term planting plan, whereas Ontario farmers needed flexibility. The *Farmer's Advocate* published many letters and commentaries from farmers and experts about efficient farm management. For example, pasture in a rotation was important as a summer feed supplement, often where land was cheap. The "Question and Answer" section of every *Farmer's Advocate* provided a forum for farmers to exchange information about individual problems and unique solutions. It is also important to note that many of the specialty crops, such as fruits, were perennial, and were unsuitable for inclusion in a crop rotation. In orchards, management of the soil around trees was achieved by cultivation and fertilizers.[49]

As time went on, weed control and soil improvement were accomplished by methods other than crop rotations. OAC conducted a comprehensive and long-term weed control experiment, in co-operation with Farmer's Union members, between 1913 and 1921. Regular cultivation, suitable cropping systems (which may be interpreted as rotations), competitive crops which grew rapidly early in the season and stifled weed growth, and chemical sprays, were all recommended for effective weed control at the conclusion of the experiment.[50] Hoeing was still one of the best ways to control weeds in row crops.[51] Summer fallow had become a method of last resort, for control of extremely persistent weeds only. Although all counties except Prescott reported some fallowed acreage in 1923, it is noteworthy that most fallowed land was in remote counties, which were relatively new to agriculture, and those which were geographically and climatically unsuited to farming. In these areas, the land was of lower productive value, and the idleness of summer fallow was not economically critical.[52]

As farmers moved towards specialization, many of those who specialized in crops kept livestock only for personal use, and manure became less plentiful. Its beneficial properties were readily acknowledged, and many farmers even imported manure onto their farm. F.C. Hart, District Rep in Waterloo county, reported that available manure was most often applied to the poorest land. Gordon Eby, who specialized in fruit and vegetable crops in Waterloo county, kept some dairy cows and also draft horses. He hauled manure, however, almost every day, often from a livery stable in Waterloo, and he even paid for it.[53] Soiling crops were grown as green manure. On Waterloo county farms, rye provided relatively inexpensive and thick growth for ploughing under. Field "pease" were sometimes used as a green manure crop, with the added advantage that they fixed nitrogen, but clover was too expensive.[54] Many farmers planted into a sod of unploughed legumes, which may or may not have been turned over.[55] Nevertheless, commercial fertilizers were sometimes required to compensate for a deficiency in soil nutrients. The *Farmer's Advocate* published a short series on fertilizers in 1910; the first part discussed nitrogen, phosphorus and potassium in the soil, and the second part discussed the purchase and application of commercial fertilizers. Beginning in 1913, the Department of Chemistry at OAC offered soil analysis and fertilizer recommendations to farmers.[56] The soil survey initiated in 1914 began an ambitious inventory of Ontario soils. One of its goals was to better service the farmer in providing soil information.[57]

Up until 1921, agricultural experts and farmers did not seem to be concerned about loss of soil productivity due to specialized farming in the way they had been concerned about soil exhaustion caused by deforestation and wheat monoculture in the 1850s and 1860s.[58] The Department of Agriculture, in its Annual Report of 1910, attributed the steady increase in average crop yields over the previous 29 years to soil fertility and improved methods of cultivation, which resulted from a harmony between the "forces of nature and the forces of man". Yield per acre had increased for practically every major crop, relative to the average for the previous 29 years, and the average itself was steadily increasing. Only peas, which were afflicted with serious insect problems during the 1910s, and turnips showed a yield decrease.[59] The report was also implicitly optimistic about the future of agriculture in Ontario. New technology would bring land of marginal usefulness into production. Breakthroughs in plant breeding and disease and pest control of-

fered hope that yield and profits would increase. After 1910, yields per acre continued to increase, albeit erratically.

Improved soil management on a mixed farm with some specialization was increasingly important to farmers. In 1906, the provincial Department of Agriculture, in conjunction with OAC staff, had begun a drainage survey and demonstration project; by 1916, hundreds of farmers had benefited from their expertise. Between 1906 and 1916 inclusive, the Department had conducted 2,445 surveys of 118,373 acres; had laid 14,494 miles of drain; and had conducted 526 demonstrations. The average attendance at these demonstrations never fell below 17 (except in 1915, during the war, when average attendance was 13).[60] The province and OAC also conducted soil surveys, compiling data about soil structure and texture, mapping, topography, and analysis of the fertility, physical and chemical components of the soil.[61] Soil drainage represented a focal point of agricultural development in Ontario, and properly drained and managed land promised an increase of more than $20 per acre.[62] Cultivation was another subject of interest, mainly with regard to weed control. The results of co-operative experiments run by the Department of Agriculture over several years were published in 1922; overall, deep thorough cultivation followed by a well-cared-for crop effectively controlled almost all perennial broadleaf and grassy weeds.[63] In the case of alfalfa seed production, a cultivated row system favoured a greater yield of larger seeds and kept weed and insect pests under control.[64] The timeliness of tillage operations was critical in some cases. Fall cultivation could improve pest control and moisture content and availability in a field.[65]

Indeed, specialization within the framework of a diverse farming operation was progressing everywhere in rural Ontario. The philosophy behind the Acre Profit Competition, which was conducted each summer by the District Reps beginning in 1914, exemplified this trend. Each county had a separate competition, and the crop to be grown was decided upon by the competitors themselves. Since the purpose of the competition was to show the possibilities of an acre of land from a financial standpoint, area farmers had to agree on a potentially successful crop, then concentrate their energy and expertise into maximizing its output. The crops chosen for the 1914 competition were as follows: potatoes in Dufferin, Thunder Bay, Parry Sound, Kenora, Welland, Grey and Ontario counties; turnips in Algoma county; mangels in Durham and Northumberland counties; silage corn in Prince Edward, Sim-

coe, Brant, Norfolk, Manitoulin and Victoria counties; seed corn in Essex and Lambton counties; barley in Lennox and Addington and Dundas counties; and oats in Middlesex, Glengarry, York, Carleton, Lanark and Bruce counties. Perhaps the most important aspect of this competition was that the results included the following data: soil type, fertilizer applied, the number of years the field had been under cultivation, the variety planted and condition of the seed regarding insects and disease, and the position of this crop in the overall farm rotation.[66] Thus, success could be interpreted within the context of the entire farm. Intellectual farming was the key to this success.

In response to arguments against specialization, Prof. J.W. Crow of OAC declared:

> Even if a man knows nothing but corn – if his thinking about corn is accurate and if he sees corn in all of its intimate relations to human welfare he is not narrowly educated and certainly is not to be regarded as inferior in mental development.[67]

By 1921, specialization in Ontario agriculture was an established fact; agricultural organizations would continue to push research, experimentation and extension further in this direction. The Acre Profit Competitions were accompanied by Beef for Profit, Feeding Hogs for Profit and Dairy Profit Competitions. The province had hired a corn specialist, a vegetable specialist, and a field crop specialist who worked mainly on potatoes, to promote specialized farming.[68]

FARM ECONOMICS IN ONTARIO IN THE 1910s

In 1916, in an attempt to make farming more efficient and business-like, OAC introduced a new cost-accounting system for growing crops. It included tables for comparing credits and costs: cost of producing crops, cost of horses' labour, and cost of machinery.[69] Intellectual agriculture was now extended to include the economics of farm management, bookkeeping, and farm finances, and the provincial Department of Agriculture undertook an extensive farm management survey, to examine the financial situation on Ontario farms. The survey included the following: 410 Oxford county dairy farms, 385 Middlesex county beef farms, 363 Dufferin county mixed farms, 340 Dundas county dairy farms, 265 Durham county apple farms, and 175 fruit farms in the Niagara district. Special investigations examined the costs of milk production on 64

Oxford county farms, and the costs of tomato production on 49 Niagara farms. In general, the most profitable farms were specialized to about 70 per cent of their activity, with sidelines which would complement the main business. For example, a dairy farmer would benefit by keeping some other livestock, to use up surplus labour and supplies, and ensure a relatively constant cash flow. The survey summarized the returns farmers received for labour, management, and opportunity costs; the majority of farmers were grossly underpaid for their work. In every report, the Department expressed a need for more efficient management by farmers. This included closer attention to modern farming techniques, such as the use of good quality livestock and registered seed. Most importantly, it stressed the need to tailor the degree of specialization to individual personal and environmental conditions.[70]

CONCLUSION

During the final quarter of the nineteenth century, when mixed farming had been widely practised, before specialized agriculture became so important in Ontario, scientific agriculture had gained importance. The Canadian government employed specialists at research centres across the country, where controlled experiments could be conducted and results compiled. By the beginning of the twentieth century, the Ontario Department of Agriculture was also establishing stations, at Thunder Bay, Monteith (north of North Bay), Vineland and Guelph, and placing District Reps in every county. A second agricultural college, to augment the teaching and research done at OAC, was planned for Kemptville, in eastern Ontario. The collection and dissemination of quantified information was understood as an aspect of modernisation.

By the early 1920s, some degree of specialization was the norm in Ontario agriculture. Regional crop specialities were based on geography and climate, and crops which were unproductive were abandoned. Some crops even disappeared from most areas. Peas had pest problems, but they were also a cool season crop, and they found optimum growing conditions in Northern Ontario, the Maritimes and on Quebec's Gaspé coast. Turnips and mangels did not store well, and were hard to handle; they were replaced by hay and silage crops.[71] The move to stored feed was further exacerbated by the increase in livestock, particularly registered beef cattle and dairy and swine herds.

Specialists were able to satisfy farmers' needs for expert advice through government publications, meetings and farm visits, and the rural press. The Ontario Department of Agriculture, in conjunction with OAC, published thousands of bulletins annually. Most of these dealt with a particular and very specific issue.[72] OAC faculty were available to discuss problems on campus with visitors, off campus on extension tours, and over the telephone, a very modern innovation.[73] District Reps were very busy all year; in 1920, the 46 Reps covered a total of 380,735 miles, and made thousands of individual contacts with farmers by mail and by telephone.[74] The rural press, of which the *Farmer's Advocate* was just one example, reached thousands of rural households. The articles and editorials published in these papers covered topics from the regional suitability of specific crops, through soil management and improvement, animal husbandry, to building designs, fencing systems and control of all manner of pests. Each question asked, and each answered, further reinforced regional specialization. An individual farmer's decision to specialise was based on circumstances of his own farm: its geography and climate, its soil type, and markets. By the early 1920s, Ontario farmers believed in specialization as their best chance to make a good living at farming in the twentieth century.

ENDNOTES

1 Ontario Department of Agriculture, *Annual Report of the Statistics Branch. Part I. Agricultural Statistics.* (Toronto, 1924), 24–34, 36–45, Tables VII–XVII, XIX–XXIV. The crops enumerated were the following: fall wheat, spring wheat, barley, oats, peas, beans, rye, buckwheat, flax, mixed grains (oats and barley seeded together), husking corn, silage corn, potatoes, turnips, mangels, sugar beets, alfalfa, hay and clover, and carrots. In a separate section, the report tabulated data for pasture, fallow, orchard and small fruits.

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3 Kenneth Kelly, "Wheat Farming in Simcoe County in the Mid-Nineteenth Century", *Canadian Geographer* 15 (1971), 106.

4 *Fifth Census of Canada* 1911, vol. IV, Agriculture, Tables 34 and 35, xlix–xlx.

5 Marvin McInnis, "The Changing Structure of Canadian Agriculture, 1867–1897", *Journal of Economic History* 42 (March 1982), 192.

6 Vittorio de Vecchi, "Science and Scientists in Government, 1878–1896 – Part I", *Scientia canadensis* 8 (Dec. 1984), 116.

7 William Brown, Professor of Agriculture and Farm Superintendent, OAC, 1876–1887; paraphrased in Tom Nesmith, "The Philosophy of Agriculture: The Promise of the Intellect in Ontario Farming, 1835–1914", unpublished PhD dissertation, Carleton University, 1988, note 31, 155.
8 "Specialty vs. Mixed Farming", *Farmer's Advocate* (hereafter cited as FA), Feb. 25, 1909, 284.
9 Editorial, "Mixed Farming Specialized", FA, Feb. 25, 1909, 281.
10 John Macdougall, *Rural Life in Canada* (Toronto, 1913), 101.
11 Louis Aubrey Wood, *A History of Farmers' Movements in Canada* (Toronto, 1975), 100.
12 The information in the section AGROMETEOROLOGICAL CONCEPTS was compiled from the following sources: L.J. Chapman, "Adaptation of Crops in Ontario", *Canadian Geographical Journal* 24 (May 1942), 248–254; Prof. R. Harcourt, W.L. Iveson and C.A. Cline, *Preliminary Soil Survey of Southwestern Ontario*, Ontario Department of Agriculture Bulletin 298, June 1923; Lloyd George Reeds, "The Agricultural Geography of Southern Ontario", unpublished PhD thesis, University of Toronto, 1955; L.W. Schut, *Soil Capability Classification for Agriculture (CLI)*, Ontario Ministry of Agriculture and Food Agdex 524, March 1985.
13 "Corn versus Roots", FA, Mar. 18, 1909, 433; "Ontario Corn Association Organized at Essex", FA, Feb. 18, 1909, 250; "Harvesting the Corn Crop", FA, Aug. 26, 1909, 1357; "Silo-filling vs. Husking", FA, Aug. 16, 1909, 1357; "Corn-cutting and Silo-filling", FA, Sept. 2, 1909, 1389; *Report of the Minister of Agriculture*, Province of Ontario (hereafter cited as RMAO) (Toronto, 1911), 47.
14 RMAO 1915, 64–65; RMAO 1916, 59–61.
15 Elizabeth Macnaughton, *The New Agriculture in Waterloo County* (Doon Heritage Crossroads, Regional Municipal of Waterloo, 1990), 158, 162.
16 Edwin Kemkes Farming diary, *Receipts and Expenses* (June 1910 and 1911), no page numbers. This diary is stored in the library at Doon Heritage Crossroads, Kitchener, Ontario.
17 "Harvesting the Corn Crop" and "Silo-filling vs. Husking", both FA, Aug. 26, 1909, 1357.
18 "Rational Fertilizing", FA, Jan. 13, 1910, 10–11.
19 RMAO 1922, 10.
20 Chapman, "Adaptation of Crops in Ontario", 253.
21 B.P. Goplen, R. Michaud, B.E. Coulman and B.R. Christie, "Forage Legumes", in A.E. Slinkard and D.R. Knott, eds., *Harvest of Gold* (Saskatoon, 1995), 236–238; Real Michaud, W.F. Lehman and M.D. Rumbaugh, "World Distribution and Historical Development", in A.A. Hanson, ed., *Alfalfa and Alfalfa Improvement* (Madison, 1988), 30.
22 RMAO 1914, 13–14; RMAO 1915, 66–67; RMAO 1916, 61–62; RMAO 1919, 69; Chapman, "Adaptation of Crops in Ontario", 253.
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24 N.C. Stoskopf, "Winter Wheat", in Slinkard and Knott, *Harvest of Gold*, 52–66.
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27 *Canada Yearbook* (Ottawa, 1910, 1915, 1921).

28 E.O. Kenaschuk and G.G. Rowland, "Flax", 173–175, in Slinkard and Knott, *Harvest of Gold.*

29 Conservation Commission, Canada, *Annual Report* (Ottawa 1919), facing 138. This photograph, entitled Smother Crop to Kill Weeds, showed a field of buckwheat, thickly sown on well-cultivated soil on an illustration farm in Dundas county, which completely killed the couch grass with which the field was badly infested.

30 *Canada Yearbook* (Ottawa, 1910), 30–31.

31 Chapman, "Adaptation of Crops in Ontario", 252.

32 For example, Macnaughton, *The New Agriculture in Waterloo County*, 56–60.

33 Charles M. Johnston, "'A Motley Crowd': Diversity in the Ontario Countryside in the Early Twentieth Century", *Canadian Papers in Rural History* 7 (1990), 242–245.

34 "Apple-Growing Depends on Soil", an interview by J.M. Henderson, Middlesex county, FA, Jan. 14, 1909, 48.

35 "Increasing Orchard Profits", FA, Feb. 11, 1909, 193.

36 Each RMAO contained a report from the Fruit Branch. See RMAO 1910, 39–41; 1911, 28–42; 1912, 30–31; 1913, 34–35; 1914, 40–42; 1915, 40–41; 1916, 40; 1917, 41; 1918, 26; 1919, 21; 1920, 29–30; 1921, 36.

37 "A Demonstration Orchard", FA, May 13, 1909, 798.

38 "Calendar Guide to Spraying", FA, Apr. 1, 1909, 527; Apr. 7, 1910, 593–594; Apr. 6, 1911, 596; Mar. 28, 1912, 583–585; Mar. 27, 1913, 578–579; Apr. 2, 1914, 648–649; Mar. 25, 1915, 487–488; Mar. 30, 1916, 562–564; Mar. 29, 1917, 536–537; Apr. 11, 1918, 637–638; Mar. 20, 1919, 591; Apr. 1, 1920, 615–616.

39 "Insects Attacking the Apple – I. Codling Moth", FA, Feb. 17, 1910, 259.

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42 "Systematic Cropping", FA, Mar. 18, 1909, 429.

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52 Ontario Department of Agriculture, *Annual Report of the Statistics Branch. Part I. Agricultural Statistics*, Table XXIV, 45, "Farm property, Implements and Livestock".
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56 "Fertilizers – I", FA, Apr. 7, 1910, 589; "Fertilizers – II", FA, Apr. 14, 1910, 630; RMAO 1914, 18.
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59 RMAO 1910, 57–59; Ontario Department of Agriculture, *Annual Report of the Statistics Branch*, Tables VII–XVII, 23–34. These tables include yield per acre for the most important field crops for each county, as well as annual averages for the periods 1882–1891, 1892–1901, 1902–1911, 1912–1921, and the cumulative average for 1882–1923.
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61 RMAO 1918, 18–19; RMAO 1919, 17.
62 RMAO 1911, 13–14.
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70 Ontario Department of Agriculture Farm Management: Part I – *The Dairy Farming Business in Western Ontario*, Bulletin 275, 1920; Part II – *The Beef Raising Business in Western Ontario. The Mixed Farming Business in Western Ontario. The Dairy Farming Business in Eastern Ontario*, Bulletin 278, 1920; Part III – *Mixed Farming and Apple Growing in Ontario*, Bulletin 282, 1921; Part IV – *The Fruit Growing Business in Niagara District*, Bulletin 286, 1921; and Part V – *Mixed Farming in the Ontario Corn Belt. Mixed Farming and Apple Orcharding in Ontario*, Bulletin 288, 1922.
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72 For lists of titles see RMAO 1911, 20–21; RMAO 1912, 17; RMAO 1913, 16; RMAO 1914, 24; RMAO 1915, 22; RMAO 1916, 24; RMAO 1917, 18–19; RMAO 1918, 23; RMAO 1919, 24; RMAO 1920, 16; RMAO 1921, 20.
73 Nyce, *The Gordon C. Eby Diaries, 1911–1913: Chronicle of a Mennonite Farmer*, May 9, 1912, 63; Edwin Kemkes Farming Diary, July 1913, no page number.
74 RMAO 1919, 24–25. This information, which included numbers of letters received and written, phone calls, visitors and meetings held in office, and circulars, bulletins and reports mailed (as well as the number of miles travelled) was published in each annual report.

BIOGRAPHICAL NOTE

Patricia Bowley is a freelance researcher/historian specializing in agricultural history. After earning a Bachelor of Science in agriculture and an MSc in Plant Science (University of Manitoba) she obtained an MA in history (University of Guelph). Her thesis was entitled "Farmers in Ontario and the Committee on Lands, Conservation Commission, Canada, 1909–1921: Realists and Romantics". She is now doing research on women handspinners in the mid-1800s, and on wheat production in Ontario since the late 1800s.